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Proposed Re-evaluation Decision PRVD2018-13

Strychnine and Its Associated End-use Products (Ground Squirrel Use)

Consultation Document

(publié aussi en français)

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Proposed Re-evaluation Decision

Under the authority of the *Pest Control Products Act*, all pesticides must be regularly re-evaluated by Health Canada's Pest Management Regulatory Agency (PMRA) to ensure that they continue to meet current health and environmental safety standards and continue to have value. Re-evaluations consider scientific data and information from pesticide manufacturers, published scientific reports and other regulatory agencies. The PMRA applies internationally accepted risk assessment methods, as well as current risk management approaches and policies, to all re-evaluations.

Strychnine is the active ingredient in restricted-class products applied as baits to control certain types of ground squirrels (Richardson's, Columbian, Franklin's, and thirteen-lined ground squirrels). Please refer to Appendix I for a list of products containing strychnine that are registered to control ground squirrels in Canada.

This document presents the proposed regulatory decision[1] specifically for the re-evaluation of ground squirrel use of strychnine,[2] including the proposed risk mitigation measures to further protect the environment, as well as the science evaluation on which the proposed decision was based. All products containing strychnine that are registered to control ground squirrels in Canada are subject to this proposed re-evaluation decision. This document is subject to a 90-day public consultation period, during which the public including the registrants and stakeholders may submit written comments and additional information to the PMRA Publications Section. The final re-evaluation decision will be published after the PMRA has taken the comments and information received into consideration.

Outcome of Science Evaluation

An evaluation of available scientific information confirmed that there are risks of concern for non-target organisms, including species at risk, for products registered to control ground squirrels.

Proposed Regulatory Decision for the Use of Strychnine to Control Ground Squirrels

Under the authority of the *Pest Control Products Act* and based on the evaluation of currently available scientific information, Health Canada is proposing that products containing strychnine for control of ground squirrels do not meet current standards for environmental protection and, are therefore, proposed to be cancelled.

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1 "Decision statement" as required by subsection 28(5) of the *Pest Control Products Act*.

2 The final re-evaluation decision for the use of strychnine to control Northern pocket gophers, skunks, pigeons, wolves, coyotes and black bears was published in REV2007-03-*Update on the Re-evaluation of Strychnine* and the required mitigation measures have since been implemented. Use of strychnine for pigeon control has since been discontinued.

International Context

Canada is a member of the Organisation for Economic Co-operation and Development (OECD), which provides a forum in which governments work together to share experiences and seek solutions to common problems.

As part of the re-evaluation of an active ingredient, the PMRA takes into consideration recent developments and new information on the status of an active ingredient in other jurisdictions, including OECD member countries. In particular, decisions by an OECD member country to prohibit all uses of an active ingredient for health or environmental reasons are considered for relevance to the Canadian situation.

Strychnine is currently registered for certain uses in other OECD member countries, including the United States and Australia, although registered uses do not include control of ground squirrels. As of 18 April 2018, no decisions by an OECD member country to prohibit all uses of strychnine for health or environmental reasons have been identified. Strychnine is currently under registration review by the United States Environmental Protection Agency.

Next Steps

The public, including the registrants and stakeholder, is encouraged to submit comments during the 90-day public consultation period[3] upon publication of the proposed re-evaluation decision.

All comments received during the 90-day public consultation period will be taken into consideration in preparation of re-evaluation decision document.[4] The re-evaluation decision document will include the final re-evaluation decision, the reasons for it and a summary of comments received on the proposed re-evaluation decision with the PMRA's responses.

The implementation timeline for the cancellation or amendments to product labels that contain the use on ground squirrels will be determined at the final decision phase of this re-evaluation, in accordance with the provisions of the PMRA's cancellation and amendments policy (Regulatory Directive DIR2018-01, *Policy on Cancellations and Amendments Following a Re-evaluation and Special Review*).

Additional Scientific Information

No additional information is requested at this time.

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3 "Consultation statement" as required by subsection 28(2) of the *Pest Control Products Act*.

4 "Decision statement" as required by subsection 28(5) of the *Pest Control Products Act*.

Science Evaluation

1.0 Summary of Previous PMRA Environmental Assessment of Strychnine for the Control of Ground Squirrels (Proposed Acceptability for Continuing Registration PACR2005-08, *Re-evaluation of Strychnine*)

The environmental assessment completed by the Pest Management Regulatory Agency (PMRA) in 2005 (PACR2005-08, *Re-evaluation of Strychnine*) indicated that strychnine is expected to be persistent in soil but immobile and not expected to leach. The registered use pattern is unlikely to result in the contamination of aquatic ecosystems and drinking water and exposure to aquatic organisms is expected to be minimal.

The risk assessment of the use of strychnine to control ground squirrels concluded that strychnine posed a risk of concern from acute exposure of birds and mammals that consume the bait directly. In addition, the risk assessment concluded that species that prey on, or scavenge animals that have been poisoned by strychnine, were at risk. Risks from short-term dietary and chronic exposure were also identified, but because of the high toxicity of strychnine and its rapid mode of action, acute primary poisonings of birds and mammals were of the greatest concern.

The use of wheat seeds and cracked corn for strychnine-treated baits was identified as a concern in the assessment as these are considered to be desirable types of food for seed-eating animals, particularly birds. The method of application of strychnine for ground squirrel control creates small concentrated areas of the treated seed that may attract non-target species. If small birds and mammals are attracted to areas where treated seeds are available, the likelihood of mortality would be considered high as only one seed may be needed to deliver a lethal dose. Subsequently, the poisoned carcasses in these areas would then attract predators and scavengers, creating the possibility of secondary poisoning.

Canadian field studies demonstrated that the use pattern for the control of ground squirrels resulted in appreciable amounts of bait being available to non-target organisms. These studies recorded a significant number of kernels of wheat being found outside of burrow entrances in the study area. Based on carcass counts in one study, it was estimated that up to 1950 songbirds were poisoned in southern Saskatchewan during the 2001 season. This estimate did not include strychnine use in other areas. Similarly, in the same study, large numbers of dead ground squirrels found above ground in areas where burrows were treated, would be available to predators and scavengers. Species of concern, including the endangered swift fox and the endangered burrowing owl, are found in the same areas and type of habitat where strychnine is used for ground squirrel control. Studies have shown that the diets of burrowing owls in these areas may include significant numbers of Richardson's ground squirrel (RGS). The owls are also known to eat other small animals which were susceptible to consuming treated bait. Therefore, burrowing owls were at risk of secondary poisoning from strychnine use.

Additionally, incident reports from the United States (1966–1999) clearly indicated that above ground strychnine use resulted in primary and secondary poisoning of non-target species. This information along with the fact that additional mitigation measures for ground squirrel control could potentially reduce, but not prevent, primary and secondary poisoning by strychnine, led to the conclusion that the use of strychnine for ground squirrel control was of concern. The assessment concluded that other measures, such as new forms of bait that are less palatable to non-target organisms and/or ways to reduce reliance on strychnine, needed to be explored.

For more details on the original assessment, please refer to PACR2005-08.

2.0 Environmental Considerations since the Publication of PACR2005-08

The current review has confirmed that risks of concern remain for non-target organisms, including species at risk, and there is concern that current mitigation measures are not practical.

2.1 Labelled Risk Reduction Measures and Compliance Monitoring

Several requirements were added to strychnine product labels as a result of the previous evaluation (PACR2005-08) to mitigate potential risk to non-target organisms. These included:

- Users were required to monitor their fields for dead ground squirrels on a daily basis for the first week after strychnine application and on a weekly basis for several weeks thereafter;
- Users were required to incinerate or bury (in a covered pit at least 46 cm deep) all treated bait or poisoned carcasses found on the soil surface; and,
- Users were required to not apply strychnine in any areas where species at risk, such as the burrowing owl (*Athene cunicularia*) and the swift fox (*Vulpes velox*), are known to frequent.

There are concerns regarding the feasibility and the practicality of the mitigation measures put in place to protect non-target organisms. It is not practical for a grower to monitor their entire field daily; it is difficult to find carcasses due to their small size, rapid deterioration and/or removal by scavengers.

From 2007 to 2010, numerous studies on the efficacy and effects of strychnine used to control RGS in the prairies were performed. Over this period of time, frequent field visits were made to sites where strychnine was being used. Although compliance monitoring data were not collected during this time, general observations were documented and suggest some non-compliance with label instructions for the product. For example, although above ground application of 2% liquid strychnine concentrate, including use in bait stations, is not a registered use, farmers were observed spreading strychnine-treated baits on field surfaces, depositing piles of treated oats or barley near the entrances of animal burrows and mixing strychnine baits with chlorophacinone-treated oats in bait stations (PMRA Document Number 2733760). It was also observed that farmers were not removing carcasses of poisoned animals from their fields as required on the label, which can result in secondary poisonings to non-target animals (PMRA Document Number 2733760).

2.2 Effect of Strychnine on Non-target Organisms

In 2002, the Richardson's Ground Squirrel Integrated Pest Management and Steering Committee was created to provide advice on sustainable control of RGS in the prairies. It consisted of experts from the agricultural producer community, industry, researchers, provincial governments and the PMRA. With direction from this Committee and funding from Saskatchewan's Ministry of Agriculture Development Fund, Advancing Canadian Agriculture and Agri-Food Fund (ACAAF) and Alberta Agriculture and Rural Development, various studies were performed with the goal of developing and promoting a pest management strategy for the control of RGS in the prairies. As part of this work, field evidence of non-target and secondary poisonings caused by strychnine in southwest Saskatchewan was collected (PMRA Document Number 2733770). This study is particularly pertinent as its purpose was to specifically assess the impact of strychnine used to control RGS in the prairies. The study was carried out using reasonable baiting procedures and in accordance with the product label. In a total of 32 plots ranging in size from 0.2 to 3.5 ha examined during the spring and summer of 2008 and 2009, 8 horned larks, 33 deer mice, 3 Chestnut-collard Longspurs, 2 Common Grackles, 1 Olive-backed Pocket Mouse, 2 Western Meadowlarks, 2 Vesper Sparrows and 1 Northern Harrier were found dead on the surface of the fields. The study also found that baiting lead to ground squirrels being found dead on the surface and ground squirrel remains were found in 33% of burrowing owl (*Athene cunicularia*) regurgitation pellets in May and at least 26% of pellets in June and July.

The fact that this many incidents were observed on these small plots suggests that far more non-target deaths are occurring on larger plots (i.e., a typical field size) and thus, these results validate the concerns identified in the environmental risk assessment. Many non-target animals were found dead in strychnine treated fields in southwest Saskatchewan as a result of primary and secondary poisonings. Ground squirrels killed by strychnine were found dead on the surface of the field and, therefore, were available to be scavenged by predators. Burrowing owls, a species at risk present in the vicinity of the study area, were found to rely heavily on a diet of small mammals between May and July with over 26% consisting of ground squirrels. As burrowing owls nesting in agricultural fields may adopt a specialized diet centered on an abundance of poisoned ground squirrels (Moulten et al. 2005 in PMRA Document Number 2733770) and considering this information indicates that the burrowing owl may also feed on dead animals (Coulombe, 1971 in PMRA Document Number 2733770), strychnine-killed ground squirrels may have an impact on the health of owls (James *et al.*, 1990 in PMRA Document Number 2733770).

Incident Reports

In accordance with the Pest Control Products Incidents Reporting Regulations, pesticide registrants are required by law to report incidents that are reported to them, including adverse effects to health and the environment, to the PMRA within a set time frame. A total of 21 strychnine-related Canadian incidents were reported to the PMRA between 2008 and 2017 involving domestic or wild animals. These reports came from various sources including the Ministries of Environment for Saskatchewan and Alberta, regional PMRA compliance offices and strychnine product users who had completed product evaluation forms. All of the incidents occurred in either Alberta or Saskatchewan and included effects on a badger, a weasel, foxes, antelopes, dogs, deer, horses, a bear cub, mice, rats, moles and various birds (for example,

magpies, ravens and eagles). Of the 18 incidents that were not clear cases of misuse, four were assigned a causality of "highly probable", two were "probable", 12 were "possible" and one had "insufficient information" (one incident was assigned two causality levels as it involved two different species with different supporting information). This information provides evidence that non-target poisonings are occurring from primary and secondary exposure.

It is highly probable that these data underestimate the extent of non-target mortalities as a result of the use of strychnine as users must actively check their fields before animal carcasses are decomposed or scavenged to make an identification of non-target mortalities in relation to strychnine use. In a field study conducted in 2002, it was determined that 7 of 50 planted ground squirrels and 19 of 50 planted ring-necked pheasants were scavenged within 3 days. These results show that scavengers are able to quickly remove carcasses of poisoned animals which would result in an underestimation of the amount of non-target mortalities that are actually occurring. Larger dead animals are likely to be more visible and easily found, and may get reported; however, it is possible that many users may not have reported or observed smaller dead birds or mammals. The available information indicates that non-target poisonings continue to occur with the use of strychnine but they are likely greatly underestimated.

Incident reports from the United States were obtained from the United States Environmental Protection Agency's Ecological Incident Information System. Details regarding incident reports from 1966 to 1999 were included in the previous assessment, PACR2005-08. From 2000 to 2015, there were 36 incident reports that did not involve clear cases of intentional misuse, of which 26 were assigned a causality determination of "highly probable", 3 were "probable" and 7 were "possible". The majority of the reported incidents involved birds, although 2 dogs and 4 foxes were also reported. Only one predatory bird species was reported, which is in line with previous observations that since the banning of above ground uses in the United States (1988), the number of incidents involving predatory birds has declined significantly. For non-predatory bird species, the number of individuals killed per incident ranged from as low as one individual to an incident involving 87 geese, and includes other large species and small species (for example, songbirds).

The incident reports show that the potential for primary and secondary poisoning resulting from strychnine use continues to exist. However, there is some uncertainty regarding the extent of non-target mortalities during this period of time as the number of unreported incidents is unknown and could be high due to the following reasons. Scavengers are known to remove carcasses of non-target primary-poisoned animals. Carcasses could be removed shortly after death and would not be counted by monitoring efforts. Also, observation of some dead animals could be missed due to their small size or deterioration. Thus, non-target mortality is likely to be significantly underestimated.

Public Literature

A search of public literature for information related to non-target poisonings due to strychnine use on ground squirrels was conducted. No information was found that was relevant to the risk assessment.

2.3 Integrated Pest Management (IPM) Strategies

The Alberta and Saskatchewan Ministries of Agriculture identified an array of IPM practices that, when used in conjunction with the application of strychnine, were expected to help reduce RGS populations. Information on the IPM strategies was communicated to users prior to their purchases of strychnine. The IPM strategies proposed included hunting, trapping, keeping vegetation height in fields at > 15 cm, installing a raptor platform, altering fields to provide better predator habitat, using other rodenticides, as well as baiting before green-up and the emergence of young RGS. The goal of the communications program was to have users adopt a variety of the suggested IPM strategies, with the outcome being lower populations of RGS and less use of and reliance on strychnine.

Data on the adoption of the IPM strategies was collected through the submission of voluntary product evaluation forms provided to strychnine users at the time of their product purchase. Results are available from Alberta (2012, PMRA Document Number 2713670) and from Saskatchewan (2012 to 2015, 2016 results not yet available; PMRA Document Number 2716238). The data collected demonstrate that the suggested IPM strategies were not widely adopted. More than 30% of users reported not using any of the non-chemical IPM strategies. In Saskatchewan, from 2012 to 2015 (PMRA Document Number 2716238), only 17–33% of users were employing two of the suggested IPM strategies and only 4–12% of users were employing three or more of the suggested IPM strategies. Of the IPM strategies that were implemented, hunting was the main non-chemical strategy employed (49–66% of users). Hunting is considered to be a reactionary approach, as opposed to other preventative methods such as keeping vegetation height at > 15 cm (1–13% of users) or providing predator habitats (2–9% of users).

In some cases, IPM strategies may not have been adopted due to lack of effectiveness and/or practicality. For example, it is difficult to maintain high vegetation in fields during dry, hot weather, which is when RGS populations are at their peak.

3.0 Value

There are two types of products containing strychnine registered for control of ground squirrels: ready-to-use (RTU) baits and concentrates containing 2% strychnine which are mixed with grains by users. Both types of products are applied as bait containing 0.4% strychnine. The bait mixed by users is labelled for use only in Alberta, Saskatchewan and Manitoba[5] to control RGS, the major pest species. The bait is applied either in burrows (concentrate and RTU) or in bait stations (RTU only).

Information considered during the value assessment included field studies conducted in Saskatchewan from 2007 to 2010, results from grower surveys and published literature. Strychnine kills ground squirrels after a single feeding and is considered to be simple to use by producers. However, the efficacy of end-use products can be affected by quality issues (for example, mouldy bait, age of product), weather, incorrect application timing and bait shyness.

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[5] Strychnine is no longer permitted for use in Manitoba by the provincial government's Wildlife Branch.

Although cancellation of strychnine for ground squirrel control would result in a loss of one chemical for this use, there are alternative active ingredients registered:

- chlorophacinone and diphacinone (multi-feed anticoagulant baits)
- zinc phosphide (non-anticoagulant bait)
- aluminum phosphide (fumigant) and
- white mustard seed powder and sodium alpha-olefin sulfonate (foam)

Similar to strychnine, the alternative active ingredients have drawbacks (for example, cost, labour, and/or efficacy), and they may be impractical under certain circumstances. Some of these limitations can be mitigated by the user; for example, efficacy may be improved by careful timing of applications. In addition, these chemical alternatives can be used in combination with monitoring, cultural controls (for example, enhancing habitat for predators, $\geq$ 15 cm tall vegetation) and physical controls (for example, trapping, shooting) to form an integrated pest management program for ground squirrels.

4.0 Proposed Re-evaluation Decision

Multiple lines of evidence (risk assessment based on available information, incident reports, information from the provinces and information generated through the IPM Committee) indicate that risks of concern for non-target poisonings continue to occur with the use of strychnine for the control of ground squirrels. Reliance on strychnine is not sustainable in the long-term due to its lack of practical mitigation measure required to protect non-target organisms as well as documented incident reports, and availability of replacement products.

In view of the unacceptable risk to non-target organisms, including species at risk, from primary and secondary poisonings, and the absence of evidence to support that IPM strategies and mitigation measures added since the last evaluation are effective, the PMRA is proposing to cancel the use of strychnine for the control of ground squirrels.

List of Abbreviations

cm	centimetre
USEPA	United States Environmental Protection Agency
IPM	integrated pest management
N/A	not applicable
OECD	Organisation for Economic Cooperation and Development
PMRA	Pest Management Regulatory Agency
RGS	Richardson's ground squirrel
RTU	ready-to-use
STR	strychnine

Appendix I Products Containing Strychnine that are Registered for Use in Canada as of 12 April 2018[6]

Registration Number	Marketing Class	Registrant	Product Name (Guarantee)	Pest(s)
31756	Technical Grade Active Ingredient	Maxim Chemical International Ltd.	Maxim Technical Strychnine (99% STR)	N/A
30433	Restricted	Maxim Chemical International Ltd.	2% Liquid Strychnine Concentrate (2% STR)	Ground squirrels (Richardson's)
23236	Restricted	Saskatchewan Association of Rural Municipalities	S.A.R.M. Gopher Poison R.T.U. (0.4% STR)	Northern pocket gophers and ground squirrels (Franklin's, Columbian, thirteen-lined, Richardson's)

6 discontinued products or products with a submission for discontinuation are not included

Appendix II Label Amendments for End-use Products Containing Strychnine

The label amendments presented below do not include all label requirements for individual end-use products, such as first aid statements, disposal statements, precautionary statements and supplementary protective equipment. Information on labels of currently registered products should not be removed unless it contradicts the label statements provided below.

STATEMENTS TO PROTECT THE ENVIRONMENT

1. As 2% Liquid Strychnine Concentrate (2% STR) (Registration Number 30433) is only registered for ground squirrel use, this product is proposed for cancellation.

2. The following label amendments are required for S.A.R.M. Gopher Poison R.T.U. (0.4% STR) (Registration Number 23236).

   a. On the front page of the label, remove "and Ground Squirrels".

   b. Under "RESTRICTED USES", delete the below text:

   "Richardsons, Columbian, Franklin and Thirteen-lined ground squirrels (*Spermaophilus richardsonii*, *S. columbianus*, *S. franklinii*, and *S. tridecemlineatus*, respectively."

   c. Under "DIRECTIONS FOR USE", delete the below text:

   "and two control measures are acceptable to control Richardsons, Columbian, Franklin or Thirteen-lined ground squirrels."

   d. Delete the below information on ground squirrel control.

   "GROUND SQUIRREL CONTROL
   HAND PLACEMENT: Place 5-15 g of bait deep in each opened burrow in such a manner that the bait is not visible from the surface. Close the burrow without burying or covering the bait and repeat treatment of any opened burrows after one week.
   BAIT STATION: As an additional method of control in an above-ground use. Place bait in a tamper resistant bait station and replenish baits as necessary. Remove and bury any dead animals because they can present a significant poisoning hazard to predatory animals. Do not place bait above ground where it is exposed to non-target species unless it is in a tamper-resistant bait station.
   If above-ground bait stations are to be used, they must meet the following criteria:
   1. Resistant to destruction or weakening by elements of typical non-catastrophic weather (e.g. snow, rain, extremes of temperature and humidity, direct sunshine, etc.)
   2. Capable of being locked or sealed so that children and non-target animals cannot gain access through the opening or procedures used to fill the bait compartment(s).

3. Strong enough to prohibit entry or destruction by dogs and by children under six years of age using their hands, their feet, or objects commonly found in the use environment (e.g. sticks, stones, broken glass, etc.- stations stronger than "tamper-resistant" are needed in areas frequented by hoofed livestock, raccoons, bears, other potentially destructive animals, or in areas prone to vandalism).
4. Equipped with rodent entrances which a) readily allow target animals access to baits, b) deny such access to animals larger than adults of the target species, and c) discourage entry by birds. Means for achieving these ends might include use of baffles, mazes, or small entrances.
5. Be anchored securely to contain contents, or equipped with a mechanism which virtually prevents bait from being shaken out of the station after it has been moved.
6. Equipped with internal structures for containing baits and minimizing spillage and tracking of bait outside of the station or into readily accessible parts of the station.
7. Made of a design and color that is not especially attractive to children, and
8. Capable of displaying precautionary statements in a prominent location."

e. Under "MONITORING", delete the below text:

"In the case of ground squirrels, monitoring must be done on a daily basis for the first week and on a weekly basis for several weeks thereafter."

f. Under "ENVIRONMENTAL PRECAUTIONS", replace "ground squirrels" with "pocket gophers".

References

A. Published Information

PMRA Document Number	Reference
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2733777	2007, Hartley, S. and G. Proulx. Rodenticide research for Richardson's Ground Squirrel control. Agriculture Knowledge Centre. http://agriculture.gov.sk.ca/Default.aspx?DN=a1820e75-bfdc-49e7-8b72-9895a7f8af2c
2733772	2011, Proulx, G., MacKenzie, N., MacKenzie, K. and K. Walsh. Efficacy of aluminum phosphide tablets to control Richardson's ground squirrel (*Spermophilus richardsonii*) populations in southern Saskatchewan, Canada. Crop Protection 30 (2011) 1039-1042. DACO 10.5.1. DACO: 10.2.3.1
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